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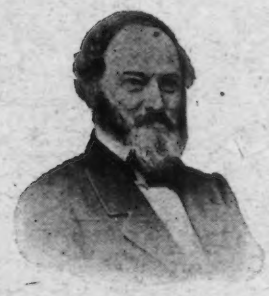

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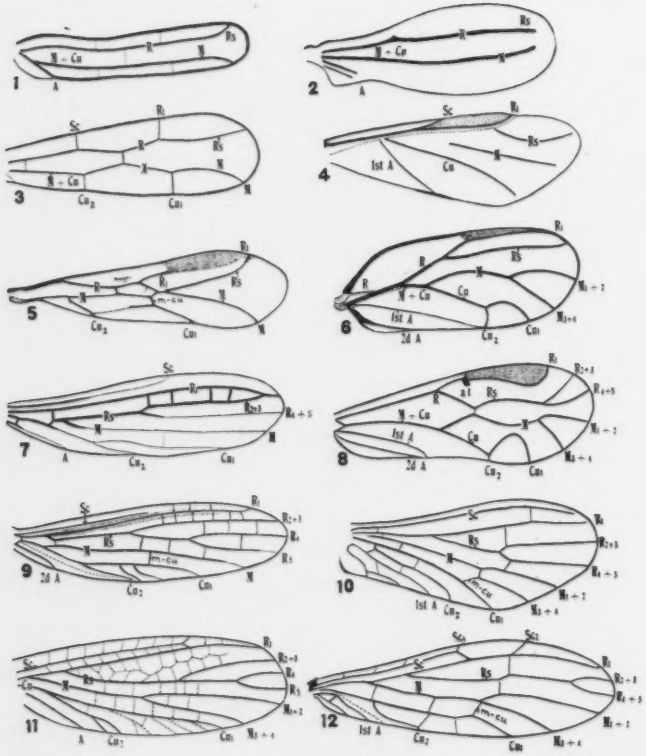

PHYLOGENETIC STUDY OF VENATION OF FORE WINGS.—CRAMPTON.

ENTOMOLOGICAL NEWS

AND

PROCEEDINGS OF THE ENTOMOLOGICAL SECTION

THE ACADEMY OF NATURAL SCIENCES, PHILADELPHIA

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A Phylogenetic Study of the Venation of the Fore Wings of the Homoptera, Thysanoptera, Psocida, Zoraptera, Neuroptera, Embiida, Plecoptera and Hadentomoida—with notes on the Hymenoptera and Coleoptera.

By G. C. CRAMPTON, Ph.D., Massachusetts Agricultural College, Amherst, Mass.

(Plate II)

Through the kindness of Mr. A. N. Caudell, I have been able to make a study of the venation of the wings of *Zorotypus snyderi,* which is of a much more primitive type than the venation of the wings of *Zorotypus hubbardi* (the only alate Zorapteron thus far figured) and is, therefore, much better for the purpose of determining the interpretation of the homologies of the Zorapteron venation, or for indicating the origin and affinities of the Zoraptera, which are among the most important forms connecting the higher with the lower types of insects. In addition to pointing out the probable homologies of the venation of the wings of the Zoraptera, I would present the evidence of the venation of these and allied

forms in support of the view that the Homoptera and Thysanoptera were descended from ancestors resembling the Psocida, and that the common ancestors of all of these forms were closely allied to the Zoraptera, which in turn lead back to ancestors resembling the Embiida (with their allies the Plecoptera) and ultimately to forms not unlike the fossil Hadentomoida, Haplopteroida, and other related insects derived from the Palaeodictyoptera.

Before taking up the subject of the evolution of the Zorapteron type of wing, I would call attention to the fact that there are two ancient tendencies traceable in the development of the wing veins, the one tending toward an *oligoneurous* type of wing with comparatively few cross veins and few branches of the main longitudinal veins, while the other tends toward a *polyneurous* type of venation with more numerous cross veins, more branches of the longitudinal veins and other features. These two tendencies apparently originated at an early date—possibly at the very beginning of the evolution of winged insects—and continuing even into the more highly modified orders, they affect the venation of these forms in varying degrees. A great development (in the hind wing) of what Handlirsch, 1906, terms the anal fan, or the feeble development of the anal region of the wing, the presence of numerous cross veins in the costal region of the wing, or the tendency to develop but few of the cross veins in this region, and the branching, or the non-branching of the subcostă, are some of the features which apparently developed at an early stage of the evolution of winged insects—possibly manifesting themselves to some extent at the very beginning of the development of the Pterygota—and it is necessary to trace such of these tendencies as are carried over into the insects related to the Zoraptera, from their earliest inception, if the lines of development of these forms are to be represented with any degree of completeness in a diagram of the phylogenetic tree of Pterygotan insects. For the purpose of the present paper, however, it will be sufficient to begin the evolutionary series with those forms arising directly from the Palaeodictyopteron stock, such as the Hadentomoida, Haplopteroida, etc., which gave rise to the types ancestral to the Zoraptera and their allies.

The Dermaptera, Embiida, Plecoptera, Haplopteroida, Hadentomoida, etc., have been grouped into a superorder called the Panplecoptera and, with the exception of some of the Plecoptera and the Dermaptera, the members of this order have not inherited much of the tendency toward the great development of the anal fan, which has passed into most of the Orthopteroid insects and those related to the Isoptera, although the Isoptera themselves were but slightly touched by it (only such primitive Isoptera as *Mastotermes* have a pronounced anal fan), and their allies, the Zoraptera, escaped it wholly. The Embiid members of the superorder Panplecoptera, lack the anal fan, and exhibit certain oligoneurous tendencies indicative of a close approach to the Zorapteron type, so that these insects, rather than the Plecoptera (which are in other respects much nearer the type ancestral to the Zoraptera), furnish the best intermediate stages in tracing the wings of the Zoraptera to the point of origin in the Palaeodictyopteroid types, from which the Embiids, Plecoptera, Haplopteroida, Hadentomoida, and allied ancestral forms, were derived.

The Haplopteroid type of wing is very like that of certain Plecoptera (although certain other Plecoptera are more like some of the Palaeodictyoptera), while the Hadentomoid type of wing, such as that shown in Plate II, Fig. 11, more nearly represents the first stages in the origin of the Embiid types (such as that shown in Fig. 9) from the Palaeodictyopteroid ancestral stock. Thus, the anal vein *A* is quite similar in Figs. 11 and 9, and the character of the cross veins between *Cu*1 and *Cu*2 in Fig. 11, is very suggestive of that occurring in the Embiid shown in Fig. 9. Vein *M* has only two branches in Fig. 11, while the reduction is carried still further in Fig. 9, in which *M* is unbranched, and this tendency for *M* to remain unbranched is carried over into the Zoraptera (Fig. 5) also. In both insects shown in Figs. 11 and 9, *R*4 and *R*5 are distinct, while *R*2 and *R*3 have apparently united to form *R*2+3, although I am not certain of the latter point in Fig. 11. Some of the cross veins are still retained in Fig. 9, but in the other Embiid shown in Fig. 7 most of them have become lost, and certain of the longitudinal veins have become

very faint, although one is still able to trace their course in the wing.

In comparing the Embiid shown in Fig. 7 with the Zorapteron shown in Fig. 5, the following points of resemblance may be noted. The cross veins between *Cu*1 and *Cu*2 have been lost (although some of them were still retained in the Embiid shown in Fig. 9), and the vein *M* is apparently unbranched. The cross vein *m-cu* of Fig. 5 is not present in Fig. 7, but its homologue occurs in the Embiid shown in Fig. 9. Vein *Rs* has only two branches in Fig. 7, while the reduction is carried still further in Fig. 5, in which *Rs* is unbranched; and in both insects, there is a tendency for *Rs* (or its branch *R*2+3) to approach *R*1. Vein *Sc* has begun to fade out in Fig. 7, and it is not visible in Fig. 5, although it may have united with radius or costa in the latter insect. In Fig. 7 there is exhibited a tendency for the veins *Rs* and *M* to extend parallel to each other down the central portion of the wing, and this tendency reappears in the insects shown in Figs. 2 and 1.

The Zorapteron type of wing (Fig. 5) approaches the Psocid type shown in Fig. 8, and it is also suggestive of other more highly modified types such as those shown in Figs. 3 and 4. On the other hand, the Psocid type of wing (Fig. 8) is also approached by that of certain Neuroptera (Fig. 10), which apparently originated from a type very like that of the Plecopteron shown in Fig. 12. Thus, the two branched condition of *M* and of *Rs* occurs in all three insects shown in Figs. 12, 10 and 8; and the character of the anals is quite similar in the three insects under consideration. From these and other features of resemblance, it is evident that collateral branches may preserve certain structures in an intermediate condition much better than is done by the more direct lines of descent, as far as these particular features are concerned, and on this account it is frequently almost as instructive to study the collateral lines as the more direct ones, if one wishes to trace the evolution of all of the features of an insect's body, or all of the modifications met with throughout an order of insects. Furthermore, the evidence furnished by a study of the venation

of the wings of the Zoraptera is suitable only for tracing the development of the oligoneurous tendencies of the Homoptera and other derived forms, while a study of the polyneurous types of Neuroptera would be of more value for tracing the origin of the tendency toward the development of polyneurous types of venation in certain Homoptera. In the present paper, however, I have concerned myself only with the oligoneurous tendencies, since it is better to discuss only one tendency at a time, and the chief aim of this paper is to point out the position of the Zoraptera, which are oligoneurous forms, in the developmental scale of the higher insects.

The contour of the head capsule, the character of the thoracic sclerites (especially the thoracic terga), the terminal abdominal segments and certain of the internal organs, such as the tightly coiled testes of the male, clearly indicate a very close relationship between the Zoraptera and the Psocida. It is, therefore, rather disappointing,* to find that the wings of the Zoraptera do not resemble those of the Psocida which I have been able to examine more strikingly than they do—although there is an undeniable resemblance between the wing of the Zorapteron shown in Fig. 5 and that of the Psocid shown in Fig. 8 in the character of the pterostigma (i. e. the stippled area in the two figures) and the tendency for the parts of the vein *Rs* to move toward *R*1. The same resemblance is traceable in the Homopteron shown in Fig. 6, since the vein *Rs* is unbranched in this insect, and approaches *R*1 near the tip of the pterostigma, or stippled area, as in Fig. 5.

The Homopteron shown in Fig. 6 is strikingly similar to the Psocid shown in Fig. 8 in the character of the anal veins, the two-branched *Cu* and *M*, and in the development of a pterostigma (stippled area); and the evidence of a close relationship between the Psyllids (Homoptera) and the Psocids drawn from other sources fully confirms that of the wing venation. I would therefore maintain that the Psyllid Homoptera and the Psocida are very closely related, and were de-

* The resemblance of both fore and hind wings of the Psocid *Archipsocus textor* to the wings of the Zoraptera is strikingly close, as has been pointed out in a paper to be published in the *Canadian Entomologist*.

scended from a common ancestry, which, from evidence drawn from other sources, was apparently closely related to the Zoraptera. In fact, the hind wing of one of the Aphid Homoptera resembles the hind wing of a Zorapteron more closely than any other insect I know of, and even in the fore wings of the two groups (*i. e.*, Aphids and Zoraptera) one can find many points of resemblance, as one may see by comparing Fig. 5 with Fig. 4.

The character of the thoracic sclerites of certain Psocida indicates a close relationship to the Thysanoptera, as is also true of the terminal abdominal structures of both sexes, and I have even found a Psocid in which the head has begun to take on the elongate form characteristic of the Thysanoptera. The wing venation furnishes a brilliant confirmation of the view that the Thysanoptera and Psocida are extremely closely related, since the wing of the Psocid shown in Fig. 2 is more like that of the Thysanopteron shown in Fig. 1, than it is like the wing of other Psocids such as the one shown in Fig. 8; and the study of the Psocids furnishes us with a ready solution of the difficult problem of determining the origin and closest affinities of that aberrant group, the Thysanoptera, which has so long puzzled the students of insect phylogeny; and the study of the venation of the wings of the Psocidae also furnishes the key to proper interpretation of the Thysanopteron venation, which is still a matter of dispute.

In both of the wings shown in Figs. 1 and 2, there are two longitudinal veins extending almost parallel to each other down the centre of the wing, while the only other veins present are relegated to the small anal lobe at the base of the wing. The veins of both wings are evidently completely homologous, and by comparing the venation of the Psocid shown in Fig. 2 with that of the Psocid shown in Fig. 8 it is a comparatively simple matter to determine the homologies of the veins of Fig. 2, and apply the interpretations thus determined, to the venation of the wing shown in Fig. 1. In the Psocid shown in Fig. 8, the veins $M+Cu$, and M, if straightened out would assume the position of the vein bearing the labels $M+Cu$ and M in Fig. 2, while the veins labeled R and Rs in Fig. 8, if straightened out,

would assume the position of the vein bearing these labels in Fig. 2. I would therefore maintain that the veins extending almost parallel to each other down the center of the wing shown in Fig. 2 represent the radius (*R*) and the media plus cubitus (*M*+*Cu*), and therefore the corresponding veins in the Thysanopteron shown in Fig. 1 would also represent the radius (*R*) and the media plus cubitus (*M*+*Cu*). The veins labeled *A* in Figs. 1 and 2, evidently represent the anals, as may be seen by comparing them with the anals (1*st A* and 2*d A*) in Fig. 8.

In Fig. 3 is shown the venation of a primitive fossil Thysanopteron, *Palaeothrips fossilis*, in which there extend from the veins *R* and *M*+*Cu* four large vertical veins connecting them with the margins of the wings. These vertical veins correspond to the small veins which have been dotted in Fig. 1, since they do not occur in the Thysanopteron there figured, although they do occur in many other recent Thysanoptera. Judging from the size and greater importance of these vertical veins in Fig. 3, I am inclined to regard them as modified branches of the longitudinal veins, rather than as mere cross veins, although in the recent Thysanoptera (Fig. 1) they have become greatly reduced, and are of relatively slight importance. A comparison of Fig. 3 with Fig. 4 would indicate that the veins labeled *R*1 and *Sc* in Fig. 3 may represent portions of *R*1 and *Sc* of Fig. 4, which have become bent forward and have assumed a vertical position. The interpretation of the veins labeled *Cu*1 and *Cu*2 in Fig. 3, however, is more difficult. The vein labeled *M* in Fig. 3 is clearly *M*, or a branch of it (*i. e.*, *M*1+2); but the vein labeled *Cu*1 in Fig. 3 seems to represent a branch of *M* (*i. e.*, M3+4) instead of representing the vein indicated by the label it bears. In the Zorapteron shown in Fig. 5, vein *Cu*1 has become detached from *Cu*2 through the partial fading out of the base of *Cu*1 (indicated by the dotted line) and if this process were continued until only the portion of *Cu*1 extending from the vein* labeled *m-cu* to the

*It might be argued that the vein labeled *m-cu* in Fig. 5 represents *M*2+3 (and that the vein labeled *M* represents *M*1+2); but a glance at the figure of the fore wing of *Zorotypus hubbardi* by Caudell, 1920, will show that there is no connection between the veins labeled *M* and *Cu*1 in Fig. 5 in Caudell's figure, and since *M* and *Cu*1 are not connected, it is hardly possible that *Cu*1 should contain a branch of *M*.

margin of the wing were retained, while this portion of *Cu*1 and vein *m-cu* became straightened out to form a vertical line, a condition very like that exhibited by vein *Cu*1 of Fig. 3, would be produced. Similarly, if vein *Cu*2 of Fig. 5 became more vertical, it would assume the position of the vein labeled *Cu*2 in Fig. 3. I would not insist on this interpretation of the venation of Fig. 3, however, since the vein labeled *Cu*2 in Fig. 3, may represent the entire cubitus (*Cu*) and the vein labeled *Cu*1 may represent vein *M*3+4, while the vein labeled *M*, may represent vein *M*1+2, and the latter view seems to be the more probable one.

As was mentioned above, the Zorapteron type of venation (Fig. 5) approaches that of the Aphids (Fig. 4); and the Homoptera, as well as the Zoraptera and Psocida, resemble the Thysanoptera in many respects. Since these forms are all very closely interrelated (judging from other structures than the wing veins) the condition occurring in one type of wing venation should throw some light upon that occurring in other related forms. I would, therefore, suggest that the basal portion of the vein labeled *R*, in Figures 3, 5 and 8, may possibly represent *Sc*+*R*, rather than *R* alone, since, in the type of venation shown in Fig. 4, the basal portion of the vein in the corresponding region of the wing evidently represents *Sc*+*R* (with which *M*, *Cu* and *A* have also united) rather than *R* alone.

(To be continued)

ABBREVIATIONS.

The abbreviations commonly employed in the Comstockian system have been used for designating the veins in the text and in figures 1-12 as follows: *Sc* (Subcosta), *R* (Radius), *M* (Media), *Cu* (Cubitus) and *A* (Anals). The numerals following the letters indicate the branches of the veins in question, thus *R*1 denotes the first branch of radius, etc. *Rs* denotes the radial sector. *m-cu* denotes the medio-cubital cross vein connecting media with cubitus. *M*+*Cu* denotes the fusion product of media and cubitus. *at* is the alatenaculum, or lobe for holding the fore wing above the hind wing when at rest.

EXPLANATION OF PLATE II.

All figures are of the right fore wing alone.

Fig. 1—*Aelothrips nasturii* (Thysanopteron), based on figure by Jones, 1912. The dotted cross-veins do not occur in this species, but are found in many other Thysanoptera.

Fig. 2—*Embidotroctes paradoxus* (Psocid), based on figure by Enderlein, 1901.

Fig. 3—*Palaeothrips fossilis* (Thysanopteron), based on figure by Scudder, 1890.

Fig. 4—*Pemphigus venafuscus* (Aphid), based on figure by Patch, 1909.

Fig. 5—*Zorotypus snyderi* (Zorapteron). The dotted portion of *Cu*1 had faded out of the right wing, but was preserved in the left wing.

Fig. 6—(Psyllid).

Fig. 7—*Oligotoma saundersi* (Embiid), based on figure by Wood-Mason, 1883.

Fig. 8—*Hemicaecilius bogotanus* (Psocid), based on figure by Enderlein, 1903.

Fig. 9—*Clothoda nobilis* (Embiid), based on figure by Enderlein, 1912.

Fig. 10—*Semidalis aleurodiformis* (Coniopterygid Neuropteron), after Enderlein.

Fig. 11—*Hadentomum americanum* (fossil Hadentomoid), after Handlirsch, 1906.

Fig. 12—*Chloroperla cydippe* (Plecopteron), after Comstock, 1918.

A New Noctuid from California (Lep., Noctuidae).

By CHAS. A. HILL, Los Angeles, California.

Litoprosopus coachella, sp. nov.

Head, palpi, collar, thorax and abdomen yellow ochre, antennae simple. Primaries yellow ochre, ordinary spots obsolete. T. A. and T. P. lines subobsolete, prominent only as a short dash from costal margin, outcurved, both of a Van Dyke brown and being only faintly traceable below subcostal vein. Apical area washed inwardly with a muddy brown in cells only, leaving the venation in slight contrast.

Secondaries concolorous with primaries, with a line in cells parallel to exterior line, both of a Van Dyke brown. In cubital cells approaching outer margin are two small white ocelli-like spots with a ring of black-brown scales, bringing same into sharp relief. Wings beneath concolorous, faint yellow ochre. Alar expanse 34-36 mm.

Habitat: Palm Springs, Coachella Valley, Riverside County, Southern California, June 13th (H. Place). *Types*: 1 ♂ and 1 ♀ in coll. Hill. Described from two specimens. Allied to *L. futilis* in that the characteristic ocelli-like spots in secondaries are present, but of a lighter color and with parallel lines in secondaries. I am indebted to Dr. Wm. Barnes, for calling my attention to the fact that this moth has not been described as being from the United States or Mexico, so I venture to describe it as a new species.

In the near future this species, with a number of rarities, taken by the author, in the same locality will be figured and an account given of this fascinating desert region.

A Synopsis of the Genera of the Anthomyiid Subfamily Coenosiinae (Diptera).

By J. R. Malloch, Urbana, Illinois.

The members of this subfamily very closely resemble those of Phaoniinae, possessing in common with them the following characters: scutellum bare below; ventral surface of prothorax with the chitinised plate between and cephalad of the fore coxae elongate, not broadly, triangularly dilated anteriorly, so that there is a large membranous area on each side of the plate; hind tarsus rarely with an outstanding setula near base on ventral surface of basal segment.

Characters which distinguish species of the subfamily from Phaoniinae are as follows: Frons without cruciate interfrontal bristles; each orbit with from 3 to 5 bristles, only the upper one directed backward, and no forwardly directed bristles in any species; thorax normally with but one well-developed pair of presutural dorso-central bristles or, if there are two pairs, the hind tibia has only three bristles, one anteroventral, one anterodorsal, and one posterodorsal, and the fifth sternite is cleft to near base; lower stigmatal bristle usually directed downward, sometimes weak or absent, in a few species directed slightly upward.

Key to Genera.

1. Lower calyptra much larger than the upper, projecting beyond it about as far as length of upper 2
—Lower calyptra not much larger than upper, projecting but little beyond it 9
2. Thorax with two pairs of postsutural dorsocentrals; hind tibia with 4 median bristles, posteroventral, posterodorsal, anterodorsal, and anterior; basal segment of hind tarsus with a long bristle near base on ventral surface .....*Bithoracochaeta* Stein
—Thorax with three pairs of postsutural dorsocentral bristles; hind tibia with at most three median bristles 3
3. Thorax with two pairs of presutural dorsocentral bristles, *Macrorchis* Rondani
—Thorax with one pair of presutural dorsocentral bristles.....4
—Thorax with the presutural dorsocentrals very short, barely distinguishable from the dorsal setulose hairs; fore femur without a continuous series of bristles on posteroventral surface, *Atherigona* Rondani
4. Costa discontinued at or slightly beyond apex of third wing-vein, *Allognotha* Pokorny

—Costa continued to apex of fourth wing-vein 5

5. Hind tibia with three median bristles, posterodorsal, anterodorsal, and anteroventral, the two former very long, the last sometimes weak or absent 6

—Hind tibia without the long posterodorsal bristle, sometimes with one or two setulae 7

6. Abdomen in male short and broad, fifth sternite with short processes which are frequently covered by the fourth tergite; fore tibia without an anterodorsal bristle in both sexes, the mid femur with a series of strong bristles on anterior surface, which does not extend much beyond middle.....*Neodexiopsis* Malloch

—Abdomen in male elongate, narrow, fifth sternite with large processes which are always conspicuously exposed; fore tibia with an anterodorsal bristle in both sexes, the mid femur with a series of widely placed strong bristles on anterior surface, the outer one about one-fourth from apex.....*Macrocoenosia* Malloch

7. Hind tibia without an anteroventral bristle; abdomen in male short and stout, sometimes with two bare glossy areas on each side; fore femur in both sexes with short setulae on entire length of anteroventral surface; ocellar bristles very short and weak, *Xenocoenosia* Malloch

—Hind tibia with an anteroventral bristle; fore femur without short setulae on anteroventral surface, or the ocellar bristles long and strong 8

8. Hind tibia with two strong, long bristles at middle, one on the anterodorsal and the other on the anterior surface, their bases very close together, almost contiguous; hind tarsus usually with a setula near base of ventral surface of basal segment, *Caricea* Robineau-Desvoidy

—Hind tibia with an anteroventral and an anterodorsal bristle which are not nearly contiguous at bases; hind tarsus usually without a setula at base on ventral surface of basal segment, *Coenosia* Meigen

9. Frons longer than broad, its sides parallel, or slightly divergent anteriorly .....*Hoplogaster* Rondani

—Frons broader than long, its sides convergent anteriorly, *Schoenomyza* Haliday

Of the genera included in this key there are two which have not been previously listed by me, *Bithoracochaeta* and *Atherigona*. The former is represented in North America by *leucoprocta* Weidemann, (*antica* Walker, *insignis* Stein), and the latter by *varia* Meigen. The specimen of *Atherigona varia* on which I base the inclusion of the genus in our list was taken by Mr. Charles Robertson at Inverness, Florida.

Gargara genistae Fabr., a European Membracid in New Jersey (Homop.).

By Harry B. Weiss and Edgar L. Dickerson,
New Brunswick, N. J.

The following notes are the results of observations made during the past two years on *Gargara genistae* found inhabiting *Caragana arborescens* at Springfield and Milburn, New Jersey. The species was identified by Mr. Funkhouser, who stated that it was very common in Europe and northern Asia, but had never before been reported from the United States. The host *Caragana arborescens* Lam., is a shrub or small tree reaching a height of 20 feet. In Bailey's Encyclopedia of Horticulture, its native home is given as Siberia and Manchuria. The members of the group to which *C. arborescens* belongs are known as pea trees. They are really ornamental shrubs grown on account of their bright yellow flowers. More than fifty species are known from south Russia to China, most of them being in central Asia. They grow in almost any kind of soil, but best in that which is sandy, and in sunny places. *Gargara genistae* was undoubtedly introduced into New Jersey in the egg stage with its host, as it was found in nurseries at both of the above mentioned localities.

According to observations made in New Jersey, overwintering takes place in the egg stage, the eggs being deposited during the latter part of July, in the two-year old wood. They were found in groups of 2 to 6, usually 4 or 5, in the bark tissue at more or less right angles to the grain. Each whitish, elongate egg rests close to and parallel with its neighbor and the bark over each group of eggs is raised or swollen somewhat like a small blister. As a rule, one side of the swelling where the eggs are inserted becomes cracked longitudinally and somewhat whitish.

Hatching takes place during the second week of June and the combined nymphal stages require about one month, the adults emerging and becoming plentiful during the second week of July. The young nymphs are somewhat greenish and resemble closely the color of the bark. As they become older,

they get darker in color. In the early stages they feed at the bases of the leaf petioles, but later migrate to the branches and main stems, where they apparently remain and complete development. Both the nymphs and adults are attended by ants and in our cages ants* were observed at various times carrying fifth stage nymphs and an adult, although no action of this kind was observed in the field. Mann (Psyche xxii. 5, 162, 1915) writes as follows, "Enslin has recently observed (Zeits. f. wiss. Insektenbiol. vol. vii, pp. 19-21) that the European ant *Formica cinerea* F., often carries into its nests nymphs and adults of *Gargara genistae* F., a common European Homopteron. Those which he observed soon died, probably because of lack of food in the subterranean nests of the ants." Both adults and nymphs are sluggish and readily captured. When disturbed they move around to the side of the twig away from the observer. The adults scatter considerably and may be found on all parts of the plant resting, usually on the twigs.

Egg. Length, 1.1 mm. Width, 0.31 mm. Whitish, translucent, obtusely rounded at one end, tapering to an acute angle at opposite end. Sides almost parallel from rounded end to about three-fifths of length, then gradually tapering to acute tip, with one side slightly flat. Alcoholic specimens show granulated appearance beneath chorion.

First Stage Nymph. Length, 3 mm. Width of head, including eyes, 0.6 mm. Form elongate, thoracic and first abdominal segments of about equal width, from which the body tapers posteriorly to acute tip. A transverse section would be triangular with median dorsal portion somewhat ridged.

Head transverse dorsally, about four times as broad as long, extending ventrally to first pair of legs. Eyes prominent, lateral. Antennae, bristle-like, on ventral side of head between the eyes, three-jointed, two basal joints sub-quadrangular, apical joint long and narrow, tapering to tip.

Prothorax somewhat longer and broader than head with sides lobed. Mesothorax slightly shorter and broader than prothorax. Metathorax slightly shorter than mesothorax at centre and about same width. Posterior margin of metathorax slightly concave and sinuate at centre. Lateral lobes of thoracic segments, especially those of meso- and metathorax, extending somewhat posteriorly.

Abdominal segments two to seven, short and broad and of about

*The species was kindly identified by Mr. M. R. Smith as *Formica fusca* var. *subsericeae*.

equal length, gradually narrowing posteriorly and with sides lobed; lobes more pronounced posteriorly. Eighth abdominal segment approximating the first seven in length, long, narrow, slightly tapering apically. Anal segment or tube linear, sides parallel, about two-thirds length of preceding segment, protrusible, in some specimens drawn within the preceding segment.

Head bearing a number of minute tuberculate spines; minute tuberculate spines on thoracic and abdominal lobes; a number of minute spines on eighth abdominal segment; dorsal, median pair of minute tuberculate spines on meso- and metathoracic and abdominal segments 2 to 7.

Legs well-developed, tibiae and tarsi bearing several minute tuberculate spines. Rostrum extending to posterior margins of metathoracic legs; lancets long.

Color: upper surface mottled brown. Ventral surface similar in color except that of abdomen, which is yellowish white. Tibia and tarsus annulated in some specimens.

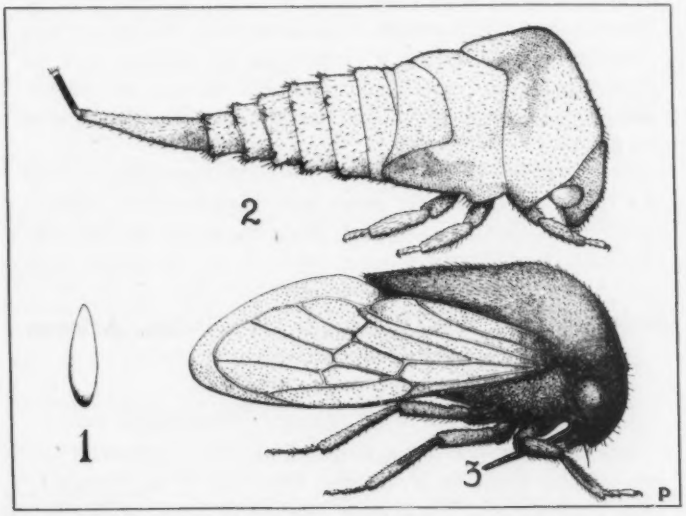
Second Stage Nymph. Length, 3.5 mm. Width of head, including eyes, 0.8 mm. Somewhat similar to preceding stage. Triangular shape and dorsal ridge more pronounced. Body less elongate, broadest at second abdominal segment. Head bent ventrally, triangular, notched at anterior dorsal apex. Mesothorax extending medianly anteriorly. Minute spines more numerous and more pronounced. Viewed laterally, thorax presents a distinct, gradually rounded crest. Eighth abdominal segment bearing double row of median spines and a lateral row on either side, together with smaller scattered spines. Dorsal tubercle bearing spines extending posteriorly. Antennae comparatively shorter than in preceding stage. Rostrum extending to second abdominal segment. Color similar to those of preceding stage.

Third Stage Nymph. Length, 4.5 mm. Width of head, including eyes, 1.1 mm. Somewhat similar to preceding stage, but less elongate and broadest across anterior portion of abdomen. Anterior ventral margin of head somewhat keeled and extending laterally in front of eyes. Crest of prothorax more pronounced. Dorsal median portion of prothorax extending posteriorly. Dorsal median portions and lateral margins of mesothorax extending posteriorly. Ridge of crest on first two thoracic segments tuberculate. A median depression between the pairs of minute dorsal spine-bearing tubercles of abdominal segments. Tubercles and spines more pronounced. Rostrum extending to second abdominal segment. Color similar to that of preceding stage; mottling more pronounced. Tip of eighth and all of ninth abdominal segment dark. Tip of ninth abdominal segment bears a circle of minute apical spines.

Fourth Stage Nymph. Length, 5.5 mm. Width of head, including eyes, 1.5 mm. Somewhat similar to preceding stage. Head bent more ventrally, being fairly well covered by prothoracic segment. Crest of prothorax more pronounced anteriorly. Wing pads of mesothorax

covering those of metathorax, which extend laterally posteriorly to second abdominal segment. Armature more pronounced. Color variable, some light, some dark.

Fifth Stage Nymph. Length, 6.7 mm. Width of head, including eyes, 1.8 mm. Somewhat similar to preceding stage. Anterior portion appearing robust on account of pronounced crest, which is largely confined to prothoracic segment, which extends medially and posteriorly.



Gargara genistae.—Fig. 1, Egg. Fig. 2, Last stage nymph. Fig. 3, Adult.

Mesothorax extending somewhat posteriorly and medially. Wing pads of metathorax extending laterally to third abdominal segment and being almost completely covered by those of mesothorax. Color variable, from light mottled brown to uniformly dark brown.

The tubercles and spines referred to in all stages are comparatively minute and scarcely visible to the naked eye.

Adult. Gargara genistae Fabr. This was described in 1781 (Fabr. Sp. Ins. II, 318) as *Cicada genistae.* "M. thorace inermi fusco, postice producto, abdomine dimidio breviore. Syst. Ent. 677.14.

Cicada thorace inermi pone producto. Geoff. Ins. I. 424.19. Habitat in *Genista tinctoria.* Angliae. Dom. Lee."

Mr. W. D. Funkhouser very generously supplied us with forty European references to this species from his MS. Cata-

logue of Membracidae and Mr. C. E. Olsen furnished us with nine additional ones. Through the kindness of Mr. Olsen and Mr. A. J. Mutchler, about half of these references were looked over in the library of the American Museum of Natural History. From them it was gathered that the species is quite common in many parts of Europe. Curtis in 1840 (Brit. Ent. Pl. 313) figured the adult and structural details together with an illustration of the food plant, *Genista tinctoria*. Buckton (1840 Mon. Brit. Cicad. vol. I, p. 7) stated that but one species of the genus was known from Britain and that it was rare and smaller than *cornutus* with which it was confused. He also figures the adults.

Distant (1907 Fauna Brit. Ind. IV, 60) states that *genistae* is a Palearctic species, the genus being distributed as follows: Palearctic, Ethiopian, Oriental, Malayan and some portions of Australasian Region.

Butterflies of the Chiricahua Mountains, Arizona (Lepid., Rhop.).

By WITMER STONE,
The Academy of Natural Sciences, Philadelphia, Pa.

This collection was made during a sojourn in Pinery Canyon, in the Chiricahua Mountains, from May 19 to August 1, 1919, as the guest of Mr. Eugene Law, of Berkeley, California. Most of our time was spent in camp in the oak and juniper belt, at 6000 feet, where openings near the stream made possible the raising of small patches of alfalfa, which when in bloom simply swarmed with butterflies. Later we camped at 6500 feet, in a region in which pines predominated, and from which the trail ascended to the high peaks—Ida's, Barfoot and Monument, which tower above the head of the canyon. The slopes of these mountains are covered with pines and Douglas fir, while the peaks themselves are more or less bald and flanked by aspen thickets. From our lower camp numerous trips were made to the foot hills at the mouth of the canyon and out onto the desert, which has an average altitude of 4000 feet.

While the collection is fairly representative, it is probably by no means complete, as it was made at odd times when opportunity offered, our main object being the collecting of birds, mammals and botanical specimens.

The identification of the specimens, which constitutes the real value of the paper, is entirely the work of Dr. Henry Skinner, to whom my sincere thanks are due. My contribution consists merely of the field notes. The entire collection of several hundred specimens has been presented to the Academy of Natural Sciences of Philadelphia.

Danais berenice strigosa. A common species in the canyon, 5000-6000 ft., during June.

Agraulis vanillae. Took one specimen on the floor of the canyon on May 21.

Euptoieta claudia. Rather common at 6000 ft., on alfalfa, in June.

Melitaea thekla. One taken in the foothills 4500 ft., June 26.

Melitaea cyneas. Common at 6000 ft., on alfalfa, during June.

Melitaea chara. Took one at our upper camp, 6500 ft., June 15.

Melitaea theona. Took one in the foothills, 4500 ft., July 29.

Synchloe nigrescens. Several seen and one obtained along a wash on the desert, 12 miles south of Dos Cabezos, May 27. (4000 ft.)

Vanessa antiopa. Saw one on the desert, May 27, and took one on Ida's Peak, 7000 ft., June 28.

Pyrameis caryae. Occasional in the canyon at 6000 ft., on thistles, June 11.

Pyrameis cardui. One secured in the foothills, 4500 ft., May 22.

Pyrameis huntera. One taken at our upper camp (6500 ft.), June 29.

Limenitis arizonensis. Rather common in narrow side canyons, flying about the trees and alighting on the foliage, closely associated with *Heterochroa*, June 1, 6000 ft.

Limenitis weidemeyeri angustifascia. Several on the summit of Monument Peak, 8826 ft., July 24. One secured.

Heterochroa bredowi. Frequent, especially flying about the trees in small side canyons, 6000-6500 ft., during June.

Epinephile xicaque. Frequent on the top of Monument Peak, 8826 ft., July 24.

Neonympha henshawi. Common on the sides of the canyon, 6000-7000 ft., among bushes close to the ground, from May to July.

Neonympha rubricata. One obtained on slopes of Ida's Peak, 7000 ft., June 15.

Lemonias nais. Took a specimen, June 23, in the canyon, 6500 ft., and another on Barfoot Peak, 8000 ft.

Lemonias palmeri. Took a single specimen, June 11, at 6000 ft., in the canyon.

Lemonias cythera. One taken on the desert at the mouth of the canyon, May 22. (4500 ft.)

Calephelis nemesis. One secured, June 12, in the canyon, 6000 ft.

Thecla siva. One obtained and others seen, June 23, on alfalfa, in the canyon, at 6000 ft.

Thecla melinus. Common at 6000-6500 ft., during June and early July, on various flowers.

Lycaena pseudargiolus echo. Common at 6000 ft., on alfalfa, May 26 to July 10.

Lycaena marina. Abundant with the last, also up to 8000 ft., on Ida's Peak.

Lycaena isola. Common with the preceding, 6000-6500 ft.

Neophasia terlooti. One secured on Ida's Peak, at 7000 ft., on June 20, and another in the canyon, at 6500 ft. Both in pine and Douglas fir forest.

Pieris monuste. Seen only on the desert and at the mouth of the canyon (4500 ft.), July 29.

Pieris occidentalis. Common in the canyon up to 6000 ft. and occasionally at 6500 ft.; also taken on the desert (4000 ft.), May and June.

Nathalis iole. Common in the canyon, at 6000 ft., May and June.

Colias caesonia. Abundant on alfalfa, at 6000 ft., May and June.

Colias eurytheme. Abundant on alfalfa with the last.

Terias mexicana. Frequent with the preceding on alfalfa, in June.

Terias damaris. One specimen obtained on June 23 with the above.

Terias nicippe. Frequent at 6000 ft. on the alfalfa, June and July 28; also on the desert (4000 ft.), May 29.

Papilio daunus. Occasional in the canyon, 6000 to 6500 ft., usually flying high over the stream, June 2 and July 20.

Papilio asterias. Common on the alfalfa, at 6000 ft., June and July.

Papilio philenor. Frequent along washes on the desert at the mouth of the canyon, May 27-29 (4000 ft.) and rarely up the canyon to 6000 ft., June 6.

Pyrrhopyge arizonensis. One specimen obtained at 6000 ft., July 29, the only one seen during the summer.

Eudamus tityrus. Frequent, 6000-6500 ft., in the canyon.

Eudamus pylades. Common at 6000 ft. in June, and one also secured on Ida's Peak at 8000 ft., June 20.

Pyrgus occidentalis. Frequent at 6000 ft. during June, and also on the desert (4000 ft.), May 29.

Thanaos clitus. One taken in the foothills, July 29 (5000 ft.)

Thanaos tristis. One taken with the preceding.

Thanaos funeralis. One taken in the canyon at 6500 ft., June 23.

Pamphila taxiles. One taken in canyon at 6500 ft., June 29.

Pamphila snowi. One taken on top of Monument Peak, 8826 ft., on July 24.
Pamphila phylaeus. Several taken in the canyon at 6000 ft.
Pamphila deva. Frequent during June at 6000 ft., on the alfalfa with the last, and one on Ida's Peak, 8000 ft., June 28.
Pamphila carus. One taken, June 23, at 6000 ft.
Pamphila campestris. One secured at same place, June 22.
Pamphila python. June 16.
Copaeodes aurantiaca. One secured in the foothills, 5500 ft., July 29.

NOTE BY HENRY SKINNER.

In addition to being an ornithologist, mammalogist and botanist, Dr. Stone is a naturalist and takes a keen interest in all living things. Some of the butterflies collected are of special interest. *Melitaea cyneas* is not common in collections. It has been recorded in the *Biologia Centrali-Americana* from Oaxaca, Mexico. *Melitaea theona* is another species better known from farther south. *Limenitis weidemeyeri angustifascia* is an interesting race, the types having been taken in the White Mountains of Arizona. So far as I am aware, *Neophasia terlooti* has not before been taken in the United States except in the Huachuca Mountains. The specimen of *Terias damaris* taken by Dr. Stone is the first one I have seen from the United States. Exact records, with date of capture, are becoming very important in the study of specific values and our conception of some of the older work is gradually changing. Every year we are learning more about the species of our western country. It was hardly possible in the past to form much of an opinion of a single specimen with only a State label.

The Maggot of the Guava in Costa Rica (Dipt., Trypetidae).

Señor C. Picado C., author of the valuable study on the epiphytic Bromeliaceae considered as a biological medium (1913) has recently worked out the life-history of the maggot which infests the guava fruit (*Psidium guava* L.). His results appear in the *Publicaciones del Colegio de Senoritas*, of San José, Costa Rica, Serie A. *Estudios Cientificos*, No. 2, 1920, entitled "Historia del Gusano de la Guayaba." The maggot is the larva of *Anastrepha striata* Schiner, as determined by Professor Bezzi. Its structure, both external and internal, and that of its parasite, *Diachasma crawfordi* n. sp. (Braconidae), are described and figured in detail and methods of control are considered. It is an interesting and valuable piece of research which, we hope, will be followed by others from the same pen.

Some Factors in the Classification of the Microlepidoptera.

By ANNETTE F. BRAUN, Cincinnati, Ohio.

It is conceded that any truly scientific system of classification should result in the grouping together of genetically related forms. Classification by means of convenient characters which arbitrarily assign species and genera to different groups without regard to phylogeny, may result in a heterogeneous mixture of species which, while possessing all the characters assigned to their respective group, and traceable to that group in a "key," are of diverse ancestry. Such a system of grouping adds nothing to our knowledge of relationship and phylogeny.

The writing of the present paper was suggested by the all too common tendency in systematic work to place undue emphasis upon some single character or set of characters which appears to solve some of the puzzling questions of relationship. It is the purpose here to point out briefly—and without intention of covering the ground completely—a few of the guiding principles which should be followed in classification and a few of the errors which it is necessary to avoid. The examples are taken from the field of Microlepidoptera not because other groups would not serve for illustration as well, but because the writer is more familiar with this group and better able to give examples.

Classification rests on the affinities shown by weighing the sum of all the characters of a form, the whole organism in all its stages. It is to be expected that in related groups, certain characters may reappear, because of a common inheritance. In genetically unrelated groups the same character may develop independently. This is one reason why no single character can be relied upon exclusively.

In classification, due regard must be paid to the relative value of different characters. The adult indicates better than any other stage the position of the species, because it represents the structure of the species after growth has ceased; it is the most specialized and most complex (except in the case of certain internal parasites). At any event it is the last product in the evolution of that species, a structure which is the final result and is influenced by all changes which have taken place in evolution both in early and adult life.

Larval and pupal characters are only of value within certain limits in determining relationships. Where larval characters contradict the evidence of the imago, they are of little or no value. In the case of free-living larvae, adaptations develop in the course of the struggle for existence. In insects with complete metamorphosis, the habits of larva and adult may differ widely, and hence the modifications of the larva may be entirely independent and of no value in classification. Thus, one only of two related organisms may have a specialized larval stage or the same adaptation may have been added independently in different groups to meet similar conditions of environment. The use of pupal characters is perhaps open to less serious criticism than the use of larval characters, as the pupa is less obviously adaptive; but it must be remembered that the pupa is an interpolated stage, due to the differences between larval and imaginal habits.

Larval and pupal characters often afford valuable confirmatory evidence in classification. For example, the similarity of the pupae of the Micropterygidae and the Trichoptera, confirms the conclusion of their near relationship based on adult structure. Where a larval character is not liable to change in evolution, and has been handed down through a group without change, for example, the fourteen-legged larva of the Gracilariidae, it can be used as a diagnostic character in placing a form in that group, where the other characters are not decisive. Even such a character must be used with care, as it may be retained in several groups merely as an inheritance from a common ancestor, and the adults may have diverged so far from one another that they would never be placed together except on larval characters.

Apparent similarity and consequent apparent relationship may result in errors of classification unless due regard be paid to the course of evolution before taking the final result as a basis of comparison. The placing of *Opostega* close to *Nepticula* is an example; while they have certain characters in common, the course of evolution in vein reduction has been totally different. It may be mentioned here that specimens of *Opostega* may be found in which the cell is faintly outlined and additional veins present in the fore wing, showing clearly

the derivation of its venation from a more generalized Lyonetiid type. This is still more strikingly shown in *Helice constrictella,* which, on the basis of empirical characters alone, would be and has been placed in the Cosmopterygidae. It is a Gelechiid, as shown by conservation of Gelechiid characters in the female only of another member of the same genus. This example is all the more significant, as the Gelechiidae are usually easily recognized by very definite characters, and emphasizes the need of a thorough study of all the characters of an organism for an understanding of its relationships.

The necessity of such a thorough study of an organism in order to determine its real phylogenetic relationship is shown nowhere better than in the Microlepidoptera. Families in the Microlepidoptera are often not distinguished by any rigid characters, although a combination of characters may be used in definition, but rather by certain general tendencies in evolution. Definite progressive changes, once initiated, continue until we find that the end product, *i. e.,* the most specialized member of a group, may be so different, that without a knowledge of the intervening phylogenetic changes, as shown by a study of homologies in existing connecting forms, we would never guess its relationship to the more primitive members of the same group.

A new method of classification for the Microlepidoptera is coming to the front. It is the science of genitalia. While there is no objection to the use of these characters in specific differentiation, or in larger group classification if used in combination with other characters, are these characters of such pre-eminent value that they can be used unsupported or in opposition to the testimony of other characters? It may eventually be possible to identify any Microlepidopteron by the male genitalia, but that is not the object of scientific classification, which seeks to show by its system of grouping, the phylogeny of the organism as a whole. Though the science of genitalia is still in its infancy, it may be necessary some day to turn our males around in our collections and let them travel backward. This new science will not classify the females, so it is a pleasant reflection in these days of equal suffrage to know that the females will still look forward.

ENTOMOLOGICAL NEWS.

PHILADELPHIA, PA., APRIL, 1921.

Thomas Bellerby Wilson.

When a man has made himself a benefactor of the human family by devoting his life and a large fortune to the promotion of science, gratitude demands that we perpetuate his memory, and uphold his example for the advancement of those sciences for which he lived. Therefore we form this memoir to commemorate the life and character of our late associate THOMAS BELLERBY WILSON.

So wrote a committee of the Entomological Society of Philadelphia, in 1865, in an appendix to the fifth volume of the *Proceedings* of the Society. Similar motives have induced the editors of the NEWS to place Dr. Wilson's portrait on the covers of this journal for 1921. Dr. Wilson was not a publishing entomologist. He was, among many other things, a collector of insects and a word picture of him in this capacity is given in the memoir quoted:

> During his residence in New London [Chester County, Pennsylvania, 1833-1841] tradition reports the surprise of the people in that vicinity when they saw him in his long walks along the brooks and through the fields, groves and woods, with his botany box on his back, his entomological net in his hands, the handle of his geological hammer extending from his coat-pocket and his hat covered all around with beetles, butterflies and other insects which he had pinned thereon.

The last item recalls the stories of the famous Napoleonic General, Comte Dejean, whom Wilson may have seen the year (1830) he studied medicine in Paris and attended the lectures of Cuvier. To the end of his life Wilson accumulated insects and especially Diptera, which he gathered around his home near Newark, Delaware, and, in earlier years, on extensive travels through the eastern United States and Canada.

But Wilson's claims to a grateful remembrance by naturalists and entomologists rest upon his gifts of money, books, collections of natural history and equipment to The Academy of

Natural Sciences and The Entomological Society, both of Philadelphia. The Memoir Committee estimated the value of these as $200,000 and $26,000 respectively. To his munificence was due the beginning and the maintenance of the publication fund of the Society, which has enabled entomologists from all parts of the United States—not from Philadelphia alone—for more than sixty years, to find means of acquainting the scientific world with their observations and reflections.

He was the first man of wealth in America who understood the importance of founding an Entomological Society with appropriate means of study. . . . The number of young men especially who devoted themselves to scientific labors in the institutions founded by him, is remarkable. And through them and through others yet to rise up, his influence will be felt in coming time beyond any definite period we can fix.

We feel sure that a reading of this memoir will more than repay for the time required and will justify our selection for our cover.

Notes and News.

ENTOMOLOGICAL GLEANINGS FROM ALL QUARTERS OF THE GLOBE

A Nomenclatorial Tangle in Anthomyiidae (Diptera).

In 1846 Macquart described *Spilogaster nitens* from Africa. Stein in 1897 described a species under the same name from North America, and it remained in that genus till removed to *Pogonomyia* by Aldrich in 1917. During those twenty years it was a straight homonym and ought to have been renamed. In 1914 I described Stein's species as *Pogonomyia flavinervis*. In his recent paper on the Anthomyiidae of the world Stein lists Macquart's species as *Spilogaster nitens* and his own as *Hylemia nitens*. The same author in his last paper on North American Anthomyiidae (1920) omits *nitens* Stein entirely as such and redescribes it as *Pogonomyia flavipennis* sp. n.

It appears from the above data that the proper specific name ought to be *Pogonomyia flavinervis* Malloch. But apart from this a fact which is more important is brought to light—that the haphazard relegation of species to genera in this or any other group of animals by even our leading authorities should be checked by making a clearcut definition of genera imperative at the time the genera are erected, and a knowledge of generic limits essential to present day authors of specific descriptions. I realize that the latter requirement is too drastic for acceptance by entomologists at least, but some check is necessary on most authors and some in particular.—J. R. Malloch, Urbana, Illinois.

Cicadas Make Final Moult Upon Leaves of Trees (Homop.).

Ordinarily cicadas make the final moult upon trunks of trees, telephone poles, fence posts and similar elevated, rather firm structures; but during last August the authors took cast skins of the last moult of cicadas from the leaves of numerous trees, among them linden, chestnut, maple, oak, elm and catalpa.

Many spent skins were noticed upon the trunks of some trees, and they occurred at miscellaneous places upon the leaves, such as upon the petioles and various places upon the blades. As many as three skins were seen upon a single leaf, some upon the lower surfaces and some upon the upper. Usually the leaves were from twenty to thirty feet from the ground, although some were lower and some were higher, and the skins were not nearly as common upon leaves as they were upon the trunks and branches. Most of the skins which were found upon the leaves were headed toward the petiole or stem end.

Since we did not see the adult insects which emerged from the spent skins we do not know the species. We do not know this habit to be common to any one particular species of the family Cicadidae.—VERNON R. HABER and W. BRUCE MABEE, Division of Entomology, Dept. of Agriculture, Raleigh, North Carolina.

Entomological Literature

COMPILED BY E. T. CRESSON, JR., AND J. A. G. REHN.

Under the above head it is intended to note papers received at the Academy of Natural Sciences, of Philadelphia, pertaining to the Entomology of the Americas (North and South), including Arachnida and Myriopoda. Articles irrelevant to American entomology will not be noted; but contributions to anatomy, physiology and embryology of insects, however, whether relating to American or exotic species, will be recorded.

The numbers in **Heavy-Faced Type** refer to the journals, as numbered in the following list, in which the papers are published.

All continued papers, with few exceptions, are recorded only at their first installments.

The records of papers containing new genera or species occurring north of Mexico are all grouped at the end of each Order of which they treat.

For records of Economic Literature, see the Experiment Station Record. Office of Experiment Stations, Washington. Also Review of Applied Entomology, Series A, London. For records of papers on Medical Entomology, see Review of Applied Entomology, Series B.

The titles occurring in the Entomological News are not listed.

4—Canadian Entomologist, London, Canada. **5**—Psyche, Cambridge, Mass. **9**—The Entomologist, London. **10**—Proceedings of the Entomological Society of Washington, D. C. **11**—Annals and Magazine of Natural History, London. **15**—Insecutor Inscitiae Menstruus, Washington, D. C. **20**—Bulletin de la Societe Entomologique de France, Paris. **39**—The Florida Entomologist, Gainesville. **45**—Zeitschrift fur wissenschaftliche Insektenbiologie, Berlin. **48**—Wiener Entomologische Zeitung. **49**—Entomologische Mitteilungen, Berlin-Dahlem. **57**—Biologisches Zentralblatt, Leipzig.

59—Journal of Agricultural Research, Washington, D. C. **72**—The Annals of Applied Biology, London. **76**—Nature, London. **82**—The Ohio Journal of Science, Columbus. **86**—The Quarterly Journal of Microscopical Science, London. **88**—Occasional Papers of the Museum of Zoology, University of Michigan, Ann Arbor. **89**—Zoologische Jahrbucher, Jena. **90**—The American Naturalist, Lancaster, Pa. **103**—Biologisches Centralblatt, Leipzig. **119**—Proceedings of the National Academy of Sciences of the U. S. A., Washington, D. C. **120**—Annalen des Naturhistorischen Museums in Wien.

GENERAL. Bateson, W.—The determination of sex [Review of Mechanisismus und physiologie der geschlechtsbestimmung by R. Goldschmidt.] **76,** cvi, 719-21. **Britton, W. E.**—Check list of the insects of Connecticut. (Conn. Geol. & Nat. Hist. Surv., Bull., 31, 397 pp.) **Gibson, A.**—Retirement of Dr. E. M. Walker as editor. **4,** liii, 25. **Goldschmidt, R.**—Die quantitative grundlage von vererbung und artbildung (Vortr. u. Aufs. u. Entwick. der Organis., Berlin, xxiv, 163 pp.) **Pickard-Cambridge, O.**—In memoriam. (Proc. Dorset Nat. Hist. & Ant. Field Club, xxxviii, xli-lii, 1917.) **Reitter, E.**—Ein nachruf von F. Heikertinger. **48,** xxxviii, 1-20.

ANATOMY, PHYSIOLOGY, &c. Bridges, C. B.—Gametic and observed ratios in Drosophila. **90,** lv, 51-61. The mutant crossveinless in Drosophila melanogaster. **119,** vi, 660-3. **Haviland, M. D.**—On the bionomics and development of Lygocerus testaceimanus, and L. cameroni, parasites of Aphidius. **86,** lxv, 101-27. **Jackson, D. J.**—Bionomics of weevils of the genus Sitones injurious to leguminous crops in Britain. **72,** vii, 269-98. **Klatt, B.**—Beitrage zur sexualphysiologie des schwammerspinners. **103,** xl, 539-58. **Payne, F.**—Selection for high and low bristle number in the mutant strain "reduced." (Genetics, v, 501-42.) **Ritchie, W.**—The structure, bionomics, and economic importance of Saperda carcharias. **72,** vii, 299-343. **Safir, S. R.**—Genetic and cytological examination of the phenomena of primary non-disjunction in Drosophila melanogaster. (Genetics, v, 459-87.) **Snodgrass, R. E.**—The mouthparts of the Cicada. **10,** xxiii, 1-15. **Sturtevant, A. H.**—Genetic studies on Drosophila simulans. I. Introduction. Hybrids with D. melanogaster. (Genetics, v. 488-500.) **Verlain, L.**—Note sur la spermiogenese et la double spermatogenese des lepidopteres. (Mem. Acad. Roy. Belgique, Clas. Sci., iv, fasc. 4.)

MEDICAL. Brues, C. T.—Insects and human welfare. (Harvard Univ. Press, 1920, 104 pp.)

NEUROPTERA. Howe, R. H.—Two interesting additions to the odonate fauna of Concord, Mass. **5,** xxvii, 154-5. **McDunnough, J.**—Dragonflies of the Lake of Bays region. Additional records of dragonflies from the Ottawa region. **4,** liii, 6-8; 14. **Tillyard, R. J.**

—A new classification of the order Perlaria. **4,** liii, 35-43. **Williamson, E. B.**—Two new Neotropical genera of Lestinae (Odonata.) **88,** 96, 9 pp.

ORTHOPTERA. Buddenbrock, W. V.—Der rhythmus der schreitbewegungen der stabheuschrecke Dyxippus. **57,** xli, 41-8.

HEMIPTERA. Barber, G. W.—A 1919 collection of Cicadellidae in the environs of Boston. **5,** xxvii, 146-50. **Bollweg, W.**—Beitrag zur faunistik und oekologie der in der umgebung Bonns vorkommenden aquatilen rhynchoten mit sonderer berucksichtigung ihrer larvenverhaltnisse. (Ver., Naturh. Ver., Preus. Rheinl. u. Westf., lxxi, 137-87.) **Parshley, H. M.**—Hemiptera collected in western New England, chiefly from mountains. **5,** xxvii, 139-43. **Riley, C. F. C.**—Distribution of the large water-strider, Gerris remigis, throughout a river system. (Ecology, ii, 32-6.) **St. George, R. A.**—Notes on the periodical Cicada in 1919. **10,** xxii, 227-31. **Stahl, C. F.**—Studies on the life history and habits of the beet leafhopper. **59,** xx, 245-52. **Weiss, H. B.**—Notes on the life history of Pachypsylla celtidisgemma. **4,** liii, 19-21. Notes on the life history and early stages of Corythucha celtidis. **82,** xxi, 104-6.

Herbert, F. B.—The genus Matsucoccus with a new species. **10,** xxiii, 15-22. **Knight, H. H.**—Hemiptera of the family Miridae of the Katmai expedition. **82,** xxi, 107-9.

LEPIDOPTERA. van Bemmelen, J. F.—The wing markings of Arctiidae. (Proc. Kon. Akad. v. Wetens., Amsterdam, xx, 849-60.) **Bowman, K.**—Annotated check list of the macrolepidoptera of Alberta—additions, 1919. **4,** liii, 13-14. Annotated check list of the macrolepidoptera of Alberta. (Alberta Nat. His. Soc., Red Deer, Alberta, Canada, 16 pp.) **Fassl, A. H.**—Beschreibung einer neuen Saturniide aus Bolivien. **120,** xxxi, 63-4. **Gschwandner, R.**—Eine neue Saturniide aus Ecuador. **120,** xxxiii, 86-7. **Heinrich, C.**—Synonymical note in Aecophoridae. **10,** xxii, 232. **Roeber, J.**—Ueber mimikry und verwandte erscheinungen bei schmetterlingen. **49,** x, 23-30 (Cont.) **Schaus, W.**—New sps. of Heterocera from South America. **15,** ix, 52-8. **Weiss & Beckwith.**—Notes on Coptodisca kalmiella, a leaf miner of Kalmia angustifolia. **4,** liii, 44-5.

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Achard, J.—Identification du Scaphidium concolor. **20,** 1920, 307. **Blaisdell, F. E.**—Four new sps. of Melyridae. **4,** liii, 15-19. **Wickham, H. F.**—New species of Perthalycra and Osmoderma. **10,** xxii, 232-34.

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INSECTS AND HUMAN WELFARE. An Account of the More Important Relations of Insects to the Health of Man, to Agriculture and to Forestry. By CHARLES THOMAS BRUES, Assistant Professor of Economic Entomology, Bussey Institution, Harvard University. Cambridge [Mass.], Harvard University Press, 1920. 8vo., pp. xii, 104, 42 figs., $2.50.—"The present volume is an attempt to present some of the principles and practices of economic entomology in a form that will illustrate the biological relationships of insects to their environment. . . . The past few decades have witnessed great changes, whereby the field of the entomologist has been greatly extended, and he has been compelled, not unwillingly, to improve his methods of investigation and to take advantage of the rapid progress made not only in zoology and botany, but in medicine and chemistry as well. He has naturally greatly improved his efficiency, and has been enabled to increase his usefulness to humanity many fold. The general public rarely appreciates fully the many economic problems in relation to insects which continually present themselves . . . the entomologist . . . has to deal with a wonderfully varied and extensive series of animals. This very fact makes it difficult to deal with insects in the brief and generalized manner applicable to other groups of animals. . . . In the following pages I have considered few of the details which may be found in many other carefully prepared volumes, but have rather attempted to avoid, as consistently as possible, matters not directly necessary for a brief consideration of insects as they affect human welfare." Having thus sketched the plan of the work in the preface, the subject matter is treated in five chapters: Insects and the Public Health (pp. 3-38), Insects and the Food Supply (pp. 39-62), Forest Insects (pp. 63-86), Household Insects (pp. 87-99), The Outlook for the Future (pp. 100-104).

In this last, after referring to the general, but unfortunate, viewpoint from which all living things are regarded as either useful or injurious to man, emphasis is laid on the variety of the methods by which noxious insects are combatted, the most promising way being regarded as the biological, the use of parasites. The appearance of insect pests in countries hitherto free from them will continue and "the specific problems of the entomologist will become more international in character." Quarantines will result only in retardation, not in exclusion, of the immigrants, and the extension of the ranges of certain disease-bearing insects will doubtless afford many unpleasant surprises.

Some curious errors occur in figure 20, on page 44, where *Colias* [*Eurymus*] *philodice* appears as "*Pontia philodice*," the American congener of the European cabbage butterfly, and is stated to have the same food plant. The remark that the economic entomologist has no criticism to make of non-rotation of crops (on page 45) is hardly comprehensible until one reads page 57. The text reference to fig. 39, on page 91, should be transferred to *Periplaneta americana* from *Blatta*

orientalis. One wonders why the spread of insects is not impeded *inversely* as the difficulty of inspection, rather than in proportion to that difficulty (page 103). PHILIP P. CALVERT.

CATALOGUE OF THE COLEOPTERA OF AMERICA, NORTH OF MEXICO. By CHARLES W. LENG, B.Sc. Published by John D. Sherman, Jr., Mount Vernon, N. Y., 1920. [See Ent. News, xxxii, p. 62, Feb., 1921.]—The long desired and most useful work on North American Coleoptera has at last appeared. So extensive is the literature on our beetles, so tangled the generic reference of many species, so many changes have been made in the nomenclature of European Coleoptera, that Coleopterists well-nigh despaired of ever having a catalogue to our species.

The volume is of 470 pages, and includes, as an introduction, an essay on classification; then follows the catalogue of the species, an appendix on Strepsiptera, a catalogue of the fossil forms by Mr. Wickham, a bibliography, and the index to genera and higher groups. The essay on classification is a succinct account of the various proposed arrangements, with critical remarks concerning them, and ends with a conspectus of families. Here the Coleoptera are arranged in two suborders, Adephaga and Polyphaga, and 22 super-families. Under the super-families are 109 families. The series ends in the Rhynchophora and Scolytoidea, the Scarabaeidae being placed before the longicorns.

In the catalogue proper the species are numbered, the whole totalling 18,547. Each species is cited by author, year and page of publication, which refers to the complete reference in the bibliography, and the known distribution by states. It is printed in double columns. Under the family, sub-family, or tribe, are references to revisional papers. Under each genus the species are arranged according to their relationships, as given by the last reviser. In the case of all but small genera it would have been far more useful to have the species arranged alphabetically.

A number of generic and several family names are strange to American entomologists, but the author has been very conservative in adopting changes in nomenclature. Coleopterists so far have been spared that confusion of nomenclature which has fallen on some of the other orders of insects. In the preparation of this catalogue proper the author has had the help of special students on certain families, Mr. Schaeffer in the Ostomidae, Mr. Sherman in Dytiscidae, Mr. Woodruff in Melandryidae, Mr. Wolcott in the Cleridae, etc. This gives added authority to the work. Species from Lower California are included, and introduced species are so marked.

The appendix on Strepsiptera lists 97 species. The catalogue of the fossil forms includes over 800 species.

The bibliography is a most useful feature; here are listed over 4,000 titles, all that have a bearing on the taxonomic study of our beetles.

In a work of this magnitude it is inevitable that there should be mistakes, but these are of a minor character, and gradually will be corrected. Anyone who, through experience, appreciates the enormous grind that this bibliographic work has entailed cannot but congratulate Mr. Leng on having successfully driven through his labor to completion. The work will undoubtedly give a new impetus to the study of beetles in our country, and we hope that before many years the interest in this dominant order of insects will be such that it will be financially possible to publish a catalogue with references to original and later descriptions after each species in the manner of other catalogues of insects. The publisher, Mr. Sherman, is also a Coleopterist, and it is largely due to his unremitting energy that the catalogue is in print.

NATHAN BANKS.

CHECK LIST OF THE INSECTS OF CONNECTICUT. By WILTON EVERETT BRITTON, Ph.D., State Entomologist and Entomologist of the Agricultural Experiment Station, New Haven, Conn. Hartford. Printed for the State Geological and Natural History Survey. 1920.—This work of 397 pages should accomplish what its author had in mind when he prepared it, to stimulate an interest in the study of insects in the State, in relation to man in the broadest sense, but with a special interest in economy.

"A work entitled a Guide to the Insects of Connecticut, containing keys to orders, families, genera, and species and including much information about life-histories, habits, distribution, etc., is already in progress."

The Check List will be very useful in the preparation of parts of the Guide to be issued, as additional species and additional facts are the natural result of such a list; in other words, interest is stimulated. Doubtless errors have crept into the list, but think of the joy that will accrue to the person finding and reporting them.

Dr. Britton is to be congratulated on the publication of such a useful list and we would like to see every State in the Union do likewise. —H. SKINNER.

LEPIDOPTERA OF THE CONGO, Being a Systematic List of the Butterflies and Moths Collected by The American Museum of Natural History Congo Expedition, Together with Descriptions of Some Hitherto Undescribed Species. By W. J. HOLLAND. Bulletin of the American of Natural History, 1920, XLIII, pp. 109-369.—This paper is well illustrated with excellent colored half-tones of numerous species and some text figures. Dr. Holland has been a student of the African fauna for many years and is well qualified to prepare such a work and the present contribution is one of real merit and value. The collection contained nearly nine thousand specimens and upwards of seven hundred and twenty-five species.—H. SKINNER.

Doings of Societies.

Entomological Workers in Ohio Institutions.

The annual state meeting of Entomological Workers in Ohio Institutions was held in the Botany and Zoology Building, Ohio State University, Columbus, Ohio, on Thursday, Feb. 3, 1921, with the following officers: Pres., J. S. Houser; Vice-Pres., H. J. Speaker; Sec., T. H. Parks.

The following papers were given:

GENERAL ENTOMOLOGY—W. M. Barrows—Insect Orientation to Heat Rays. R. C. Osborn—Next Steps in Entomological Study. W. C. Kraatz—Notes on Aquatic Insects in Ohio. C. L. Metcalf—The Elementary Course in Economic Entomology. F. H. McMillen—How Entomology is Taught by the Smith-Hughes Teacher. Ford S. Prince—Entomology's Place in County Agent Work. H. E. Evans—The Farmer and Taxpayer's Opinion of the Application of Entomological Control Methods. E. L. Wickliff—Insect Food of Certain Ohio Fishes.

ECONOMIC AGRICULTURAL ENTOMOLOGY—E. L. Chambers—Greenhouse Insect Control on a Commercial Scale. P. R. Lowry—Economic Importance of Mealy Bugs in Ohio. E. C. Cotton—Recent Developments of Gypsy Moth and European Corn-borer Liable to be Introduced. W. O. Hollister—The Tree Surgeon's Knowledge of Entomology. J. S. Houser—Control of the Cucumber Beetle. H. A. Gossard—Devices for Recording the Emergence of Hessian Fly Broods. T. H. Parks—Some Remarks on Hessian Fly and Its Control. E. W. Mendenhall—Some of the Insect Pests Found in Northeastern Ohio. W. S. Hough—Methods Employed to Control and Eradicate the Pink Boll Worm.

ODONATA—C. H. Kennedy—Notes on Dragon Flies.

HOMOPTERA—E. A. Hartley—Remarks on Some Aphid Parasites.

HYMENOPTERA—L. L. Huber—Remarks on a Chalcidoid Parasite.

COLEOPTERA—W. V. Balduf—Life History and Habits of the Cucumber Beetle.

INSECTS AND DISEASE—J. S. Hine—Blood-sucking Insects Observed on the Katmai Expedition.

Newly elected officers: *President*, C. L. Metcalf; *Vice-President*, E. W. Mendenhall; *Secretary*, T. H. Parks.

The following additional entomologists were in attendance: W. H. Larrimer, Lafayette, Ind.; R. W. Kelly, Cleveland, Ohio.; Richard Faxon, Elyria, Ohio.; R. S. McKay, Batavia, Ohio; C. R. Cutright, C. O. Eddy, F. E. Guyton, A. E. Miller, W. B. Noble, of the Ohio State University.

T. H. PARKS, *Secretary.*

EXCHANGES

This column is intended only for wants and exchanges, not for advertisements of goods for sale. Notices not exceeding three lines free to subscribers.

These notices are continued as long as our limited space will allow; the new ones are added at the end of the column, and only when necessary those at the top (being longest in) are discontinued.

For Exchange—Iowa Catocalae in A-1 condition. Wanted, Cocoons of Actias luna also other lepidoptera. Mrs. O. F. Hiser. Arnolds Park, Iowa.

Books Wanted—Entomological News, Vol. 11, Nos. 1, 3, 5; Vol. 14, Nos. 1, 7. Brooklyn Museum Library, Eastern Parkway and Washington Ave., Brooklyn, N. Y.

Wanted—N. A. Coleopterists interested in European Coleoptera. Liberal exchanges and friendly correspondence. Mr. C. Crozet, 155, Via Cavour, Rome, 23, Italy.

Wanted—To purchase or exchange papers and books on insect Biology, Ecology and Behavior, especially aquatic Hemiptera.—C. F. Curtis Riley, Department of Forest Zoology, The New York State College of Forestry at Syracuse University, Syracuse, N. Y.

Wanted—North American or European Coleoptera to determine in exchange for specimens.—R. T. Garnett, 625a 14th st., Oakland, Cal.

Wanted—Species of Rhynchophora from Eastern North America not represented in my collection, in exchange for duplicates from Indiana and Florida. Lists of desiderata and duplicates on application.—W. S. Blatchley, 1530 Park Ave., Indianapolis, Indiana.

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Urania boisduvali
Erinyis guttalaris
Protoparce brontes, etc.

From Venezuela:
Over 5000 Lepidoptera
200 Dynastes hercules

From New Guinea
2000 Coleoptera
200 Orthoptera

From Assam, India:
1200 BUTTERFLIES AND MOTHS, INCLUDING

Papilio arcturus
" philoxenus
Kallima inachis
Brahmaea wallachi

And Many Other Showy Species

From Tibet (Bhutan):
Armandia lidderdalii
Parnassius hardwicki

CATALOGUES OF
ENTOMOLOGICAL SUPPLIES AND SPECIMENS
ON APPLICATION

If interested kindly send your list
of desiderata for further information to

THE KNY-SCHEERER CORPORATION OF AMERICA

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